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(54) BIOCIDAL PREPARATION

(71) We, TH. GOLDSCHMIDT A.G., a body corporate organised under the Laws of Germany, of 100 Goldschmidtstrasse, 43 Essen, Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to biocidal preparations.

Compounds of the general formula:

in which R^1 is an alkyl radical with from 8 to 18 carbon atoms or a benzyl radical which may be chlorinated or brominated in 2 and/or 4 positions possess valuable biocidal properties. These compounds are described and claimed in the Specification of our co-pending Patent Application No. 7621 of 1970 (Serial No. 1,254,983) filed on even date herewith. These compounds, which are N-substituted diaminopyridines, can be dissolved in organic solvents or dispersed in strongly acid aqueous media. As a result of the sparing solubility of these compounds in water, however, it is not possible to produce clear aqueous solutions of high concentration with an effective content of these compounds at pH values which at least approximate physiological values. However, clear disinfectant preparations are most desired if the production of the solutions for use is carried out with automatic dosing appliances, as is frequently the case in modern consumption units. In this case, suspended substances upset the sensitive dosing mechanism.

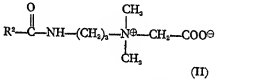
Solubilisers such as non-ionic, anionic or cationic surface-active agents make possible the production of clear aqueous solutions of substances which in themselves are sparingly soluble in water. However, whilst so doing they usually greatly decrease the biocidal activity of the solubilised compounds.

It has now surprisingly been found that certain surface-active betaines, which themselves have a slight bacteriological activity, make possible the production of biocidal preparations of increased activity and good water solubility from the aforesaid N-substituted diaminopyridines.

According to the present invention there is provided a biocidal preparation, comprising a mixture of a compound of the general formula:

(I)

in which R^1 is an alkyl radical with from 8 to 18 carbon atoms or a benzyl radical which may be chlorinated or brominated in the 2 and/or 4 positions and a compound of the general formula:



(II)

in which R^2 is an alkyl radical with from 7 to 17 carbon atoms, the compounds I and II being present in the mixture in proportions by weight of from 2:1 to 1:5.

Naturally it is also possible for the compounds of the general formula I themselves to be mixtures of compounds with alkyl radicals of different chain lengths, such as is the case, for example, if the compounds are produced by reacting 2,6-diaminopyridine with an alkyl halide or alkyl sulphate which is derived

[1-

from natural fats or products of an oxo synthesis.

The same applies to the compounds of the formula II in respect of the radical R^2. For example, R^1 may be an octyl radical and R^2 may be a mixture of alkyl radicals comprising 70 mole % of $C_{11}H_{23}$— radicals and 30 mole % of $C_{17}H_{35}$— radicals.

This discovery is particularly surprising because compounds related chemically to compounds of formula I, such as surface-active amines, quaternary ammonium compounds and surface-active amino-acids, which are quite active bacteriologically as such, are adversely affected in their activity by the addition of compounds of formula II. An even more pronounced loss of activity is suffered by various bactericidal products with a structure which differs more greatly chemically, for example halogenated-alkylphenols or halogenated-arylphenols and organo-tin compounds.

Such a decrease in the bactericidal effect has a particularly disadvantageous effect in practice when there are in any case more or less prouonced adverse effects on the biocidal activity as a result of proteins and lipoids which are present everywhere as impurities. Here again the present preparation is found to be superior.

The compounds of formula I can be produced by reacting 2,6-diaminopyridine with an alkyl halide or alkyl sulphate or with a chlorinated or brominated benzyl halide, preferably in the presence of an acid acceptor.

The compounds of formula II can be produced in accordance with the disclosure in German Patent Specification No. 1,062,392.

The production of the present synergistic mixture of compounds is carried out simply by dissolving the compound of formula I with the addition of an acid such as hydrochloric acid, sulphuric acid, phosphoric acid, acetic acid or lactic acid in an aqueous solution of the compound of formula II so that a pH of 7 or less results. The proportions by weight of the mixture of the compounds of formula I and II can vary within the limits of from 2:1 to 1:5. The present mixtures are obtained in this way as clear, faintly coloured aqueous solutions, the odour of which is determined in the main by the acid used, because the intrinsic odour of the compounds of formulae I and II is hardly perceptible.

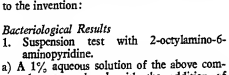
The present preparations can be in the form of aqueous solutions which in addition contain one or more further conventional additives such as inorganic compounds, dyestuffs, perfumes, and thickeners. The preparations, however, can also be in paste or solid form and be converted into the aqueous form only just before or during use.

From the bacteriological tables, which follow and in which all percentages are percentages by weight, it is possible to see clearly the superiority of the preparations according to the invention:

Bacteriological Results

1. Suspension test with 2-octylamino-6-aminopyridine.

a) A 1% aqueous solution of the above compound was produced with the addition of 0.8% of a compound of the formula:



(III)

in which R^2 represented a mixture of alkyl radicals with 70 mole % $C_{11}H_{23}$— and 30 mole % $C_{17}H_{35}$—, which acted as a solubiliser, but was practically inert bacteriologically, as was shown by comparative tests.

The pH value of the 1% solution of active principle was 4.3.

+ = bacterial growth

— = no bacterial growth

Test strain	Concentration %	Time of action in minutes 1	2	5	10	20	30
Staphylococcus	0.1	—	—	—	—	—	—
aureus	0.05	—	—	—	—	—	—
	0.01	+	+	—	—	—	—
	0.005	+	+	+	+	+	+
Pseudomonas	0.1	—	—	—	—	—	—
aeruginosa	0.05	—	—	—	—	—	—
	0.01	—	—	—	—	—	—
	0.005	+	+	+	+	+	+
Proteus vulgaris	0.1	—	—	—	—	—	—
	0.05	—	—	—	—	—	—
	0.01	—	—	—	—	—	—
	0.005	+	+	+	—	—	—
	0.001	+	+	+	+	+	+
Escherichia coli	0.1	—	—	—	—	—	—
	0.05	—	—	—	—	—	—
	0.01	—	—	—	—	—	—
	0.005	+	—	—	—	—	—
	0.001	+	+	+	+	+	—

b) A 1% aqueous dispersion of 2-octylamino-6-aminopyridine without the addition of the compound of formula III was produced with the addition of acetic acid, so that once again a pH of 4.3 resulted.

Test strain	Concentration %	Time of action in minutes 1	2	5	10	20	30
Staphylococcus	0.1	–	–	–	–	–	–
aureus	0.05	+	–	–	–	–	–
	0.01	+	+	+	–	–	–
	0.005	+	+	+	+	+	+
Pseudomonas	0.1	–	–	–	–	–	–
aeruginosa	0.05	+	–	–	–	–	–
	0.01	+	+	–	–	–	–
	0.005	+	+	+	+	+	+
Proteus vulgaris	0.1	–	–	–	–	–	–
	0.05	+	–	–	–	–	–
	0.01	+	+	–	–	–	–
	0.005	+	+	+	+	+	–
Escherichia coli	0.1	–	–	–	–	–	–
	0.05	–	–	–	–	–	–
	0.01	+	–	–	–	–	–
	0.005	+	+	+	+	+	–

As can be seen from a comparison of the results of tests 1a) and 1b), the mixture according to the invention 1a) surprisingly shows a better bacteriolgical activity than 1b).

2. Testing the protein defect of 2-octylamino-6-aminopyridine.

A solution as described under 1a) was used, except that 20% of bullock serum was added to the individual dilution stages. The bacteriological activity was only slightly affected by this, as can be seen from the following table:

Test strain	Concentration %	Time of action in minutes 1	2	5	10	20	30
Staphylococcus	0.1	—	—	—	—	—	—
aureus	0.05	—	—	—	—	—	—
	0.01	+	+	+	+	+	+
Pseudomonas	0.1	—	—	—	—	—	—
aeruginosa	0.05	—	—	—	—	—	—
	0.01	+	+	+	+	+	+
Proteus vulgaris	0.1	—	—	—	—	—	—
	0.05	—	—	—	—	—	—
	0.01	+	+	+	+	+	+
Escherichia coli	0.1	—	—	—	—	—	—
	0.05	—	—	—	—	—	—
	0.01	+	+	+	+	+	+

3. Bacteriological investigations on comparative substances.
a) The bacteriological activity of

$$C_{15}H_{31}NH—CH_2—CH_2—NH—CH_2—CH_2—NH—CH_2COOH$$

without the addition of a compound of formula II.

Test strain	Concentration %	Time of action in minutes 1	2	5	10	20	30
Staphylococcus	0.1	−	−	−	−	−	−
aureus	0.05	−	−	−	−	−	−
	0.01	−	−	−	−	−	−
	0.005	+	−	−	−	−	−
	0.001	+	+	+	+	+	−
Pseudomonas	0.1	−	−	−	−	−	−
aeruginosa	0.05	−	−	−	−	−	−
	0.01	+	+	+	+	+	−
Proteus vulgaris	0.1	+	−	−	−	−	−
	0.05	+	+	−	−	−	−
	0.01	+	+	+	−	−	−
Escherichia coli	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	+	+	+	+	−	−

b) Bacteriological activity of

$$C_{12}H_{25}NH—CH_2—CH_2—NH—CH_2—CH_2—NH—CH_2COOH$$

with the addition of a compound of formula III (proportion of mixture on a molar basis 1 : 1).

Test strain	Concentration %	Time of action in minutes 1	2	5	10	20	30
Staphylococcus	0.1	−	−	−	−	−	−
aureus	0.05	+	+	−	−	−	−
	0.01	+	+	+	−	−	−
	0.005	+	+	+	+	+	+
Pseudomonas	0.1	+	−	−	−	−	−
aeruginosa	0.05	+	+	+	−	−	−
	0.01	+	+	+	+	+	+
Proteus vulgaris	0.1	+	+	−	−	−	−
	0.05	+	+	+	+	−	−
	0.01	+	+	+	+	+	+
Escherichia coli	0.1	+	−	−	−	−	−
	0.05	+	+	−	−	−	−
	0.01	+	+	+	+	+	−

c) Bacteriological activity of

without the addition of a compound of formula II.

A 10% solution of 1,2-propyleneglycol was produced and this was then diluted with water to the corresponding concentrations.

Test strain	Concentration %	Time of action in minutes 1	2	5	10	20	30
Staphylococcus	0.1	−	−	−	−	−	−
aureus	0.05	+	+	−	−	−	−
	0.01	+	+	+	+	+	+
Pseudomonas	0.1	+	+	+	−	−	−
aeruginosa	0.05	+	+	+	+	+	+
	0.01	+	+	+	+	+	+
Proteus vulgaris	0.1	−	−	−	−	−	−
	0.05	+	−	−	−	−	−
	0.01	+	+	+	−	−	−
Escherichia coli	0.1	−	−	−	−	−	−
	0.05	−	−	−	−	−	−
	0.01	+	+	+	−	−	−

d) Bacteriological activity of

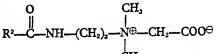
with the addition of a compound of formula III.

A 10% solution of chloroxylenol in a mixture of 1,2-propylene-glycol and so much compound of formula III was produced that when diluted with water to 0.1%, a clear aqueous solution resulted. The proportion of chloroxylenol to compound of formula III being 1.3 by weight. This was found to be completely ineffective when tested for a period of 30 minutes against all four test strains.

WHAT WE CLAIM IS:—

1. A biocidal preparation, comprising a mixture of a compound of the general formula:

in which R^1 is an alkyl radical with from 8 to 18 carbon atoms or a benzyl radical which may be chlorinated or brominated in the 2 and/or 4 positions and a compound of the general formula:



(II)

in which R^2 is an alkyl radical with from 7 to 17 carbon atoms, the compounds I and II being present in the mixture in proportions by weight of from 2:1 to 1:5.

2. A preparation as claimed in Claim 1, wherein the preparation is in the form of an aqueous solution.

3. A preparation as claimed in Claim 1, wherein the preparation is in the form of a paste or solid.

4. A preparation as claimed in any preceding Claim, wherein R^1 is an octyl radical and R^2 is a mixture of alkyl radicals comprising 70 mole % of $C_{12}H_{25}$— radicals and 30 mole % of $C_{17}H_{35}$— radicals.

5. A preparation as claimed in any preceding claim, wherein the preparation contains one or more conventional additives.

6. A biocidal preparation substantially as hereinbefore described with reference to Test 1(a) of the foregoing Tests.

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